(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 942 631 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
15.09.1999 Bulletin 1999/37

(51) Int. Cl.[6]: **H05B 37/02**, A63D 1/00

(21) Application number: **99301842.3**

(22) Date of filing: **11.03.1999**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **11.03.1998 US 38449**

(71) Applicant:
BRUNSWICK BOWLING & BILLIARDS CORPORATION
Muskegon Michigan 49443 (US)

(72) Inventors:
- **Recknagel, Troy Arnold**
  Muskegon, Michigan 49441 (US)
- **Richardson, William Orvil**
  Grand Haven, Michigan 49417 (US)

(74) Representative:
Miller, James Lionel Woolverton et al
Kilburn & Strode,
20 Red Lion Street
London WC1R 4PJ (GB)

(54) Bowling center lighting system

(57) The lighting system (100) of the present invention includes at least one light string (130_n) having a plurality of independently controllable light modules (140_n), each emitting light in response to an activation signal uniquely associated with the light module. The lighting system (100) preferably includes a controller (110) coupled to the light strings for generating and transmitting activation signals to the light modules to independently control the lights of the light modules. Each of the light modules may include a multi-color lighting device (32,34,36) for emitting light of different colors such that the controller may select colors of the light emitted from each one of the light modules. The lighting system may also include a plurality of address modules (120_n) each associated with and coupled to one of the light strings and coupled to the controller so that the controller may transmit activation signals to the light modules of a specific light string by transmitting an address to which the associated address module will respond by enabling the light modules of the associated light string to respond to the activation signals transmitted with the address signal from the controller.

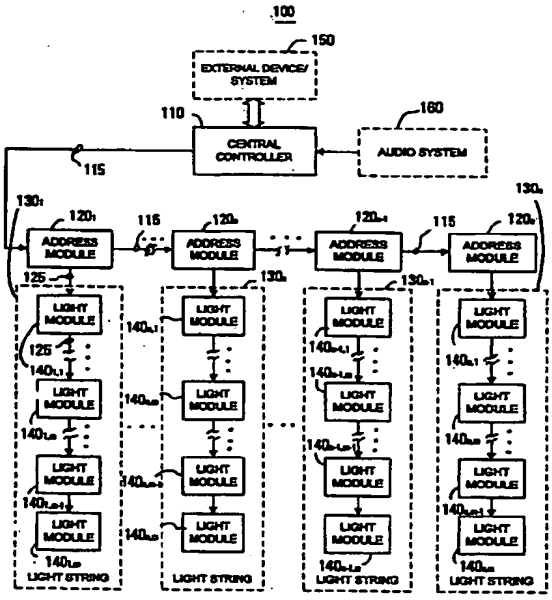


FIG. 1

EP 0 942 631 A2

[0017] Preferably, said central controller includes an interface for connecting to a bowling scoring system, said central controller being responsive to signals received from said bowling scoring system for generating and transmitting activation signals to said light modules so as to create a selected graphic display pattern.

[0018] Preferably, said central controller is responsive to a signal from the bowling scoring system that identifies a bowling lane and an event that occurred at the identified bowling lane by generating and transmitting activation signals to light modules associated with the identified bowling lane so as to generate a lighting display pattern for the identified bowling lane.

[0019] Preferably, said central controller includes an audio interface for connection of an output of an audio device, said central controller generates and transmits activation signals to said light modules in order to generate a light pattern on said plurality of light strings that changes in appearance in response to changes in a characteristic of an audio signal received from the audio device.

[0020] Preferably, said central controller includes a memory for storing data representing a plurality of lighting patterns, said central controller selects one of the plurality of lighting patterns, reads the stored data representing the selected data pattern, and generates and transmits activation signals to said light modules in order to generate the selected light pattern on said plurality of light strings.

[0021] Preferably, said plurality of light strings are physically mounted in parallel to one another.

[0022] Preferably, said plurality of light strings are mounted in a single plane.

[0023] Preferably, the light modules of a light string are coupled in series.

[0024] Preferably, the system includes a plurality of division capping assemblies mounted on each lane pair divider, each of said division capping assemblies define a channel and have a transparent cover such that a light string may be run within said channel and the light from the light modules may be emitted through said transparent cover.

[0025] Preferably, the address module and the light modules of an associated light string include a serially connected shift registers responsive to a clock signal transmitted from said central controller to receive a data stream also transmitted from said central controller.

[0026] Preferably, said central controller transmits a load signal each time a data stream is transmitted, each said address module responds to the load signal by enabling the load signal to be transmitted to the associated light modules if the data stored in the shift register of the address module at the time the load signal is received corresponds to the unique address of the address module, whereby each of said light modules respond to said load signal by controlling the light emitted therefrom in accordance with the data stored in the shift register of the light module at the time the load signal is received.

[0027] Another aspect of the invention provides a lighting system, for example for a bowling center, having at least two bowling lanes, said lighting system comprising a light string disposed along a divider separating said two bowling lanes, said light string including a plurality of light modules each including a multi-color lighting device for emitting light having one of a plurality of selectable colors.

[0028] Preferably, each of said light modules includes a red LED, a green LED, and a blue LED, said LEDs being independently activated in response to an activation signal.

[0029] Preferably, the system includes a controller coupled to said light string for generating and transmitting activation signals to said light modules to independently activate said light sources of said light modules.

[0030] Another aspect of the invention provides a wide-area graphic display system comprising: a plurality of light strings each including a plurality of independently controllable light modules that emit light in response to an activation signal uniquely associated with each light module; a plurality of address modules each associated with and coupled to one of said light strings; and a central controller coupled to said plurality of address modules for generating and transmitting activation signals to said light modules to independently control said light modules, wherein said central controller transmits activation signals to the light modules of a specific light string while transmitting therewith an address to which the address module associated with the specified light string will respond by enabling the light modules of the associated light string to respond to the activation signals transmitted from said central controller to thereby generate a graphic display.

[0031] Preferably, each of said light modules includes a multi-color lighting device for emitting light of different colors such that said central controller may select colors of the light to be emitted from each one of said light modules.

[0032] Preferably, each of said light modules include a red LED, a green LED, and a blue LED, said LEDs being separately controllable such that said central controller may separately select one of at least seven different colors to be emitted from each of said light modules by transmitting an activation signal to selected ones or combinations of said red, green, and blue LEDs.

[0033] Preferably, said central controller includes an audio interface for connection of an output of an audio device, said central controller generates and transmits activation signals to said light modules in order to generate a light pattern on said plurality of light strings that changes in appearance in response to changes in a characteristic of an audio signal received from the audio device.

[0034] Preferably, said central controller includes a memory for storing data representing a plurality of lighting patterns, said central controller selects one of the

strings bordering the identified lane.

[0051] Preferably, said control circuit is responsive to a signal from the automatic scoring system that identifies a bowling lane and an event that occurred on the identified bowling lane by selecting a display pattern associated with the identified event creating a light show having the selected display pattern on the light strings bordering the identified lane.

[0052] Preferably, said control circuit includes an audio interface for connection of an output of an audio device, said control circuit generates and transmits activation signals to said light modules in order to generate a light pattern on said plurality of light strings that changes in appearance in response to changes in a characteristic of an audio signal received from the audio device

[0053] Preferably, each of said light modules includes a multi-color lighting device for emitting light of different colors such that said control circuit may select colors of the light to be emitted from each one of said light modules

[0054] In another aspect of the present invention there is provided a lighting system that allows independent control of each lighting element of the system.

[0055] Another aspect of the present invention provides a lighting system m which the color of each lighting element in the system may be independently selected and dynamically changed.

[0056] Yet another aspect of the present invention provides a lighting system in which each of the lighting elements may be independently controlled by a control circuit so as to enable an unlimited number of graphic lighting patterns to be displayed.

[0057] Still another aspect of the present invention provides a lighting system in which each of the lighting elements is independently addressable and the lighting elements are arranged in a plurality of linear strings so as to be well-suited for implementation along the division caps of a bowling center.

[0058] In accordance with and to achieve these and other aspects and advantages, a lighting system in accordance with the present invention may comprise, in another aspect, at least one light string including a plurality of independently controllable light modules each emitting light in response to an activation signal uniquely associated with the light module. The lighting system preferably includes a controller coupled to the light strings for generating and transmitting activation signals to the light modules to independently control the light modules. Each of the light modules may include a multi-color lighting device for emitting light of different colors such that the controller may select colors of the light emitted from each one of the light modules. The lighting system may also include a plurality of address modules each associated with and coupled to one of the light strings and coupled to the controller so that the controller may transmit activation signals to the light modules of a specific light string by transmitting an address to which the associated address module will respond by enabling the light modules of the associated light string to respond to the activation signals transmitted with the address signal from the controller.

[0059] The controller may include an interface, for connection to an external system, such as the bowling center's bowling scoring system. In this manner, the controller may generate a specific light display in response to signals received from this external system. For example, when a bowler rolls a strike, the bowling scoring system may signal the central controller of the lighting system to generate a pattern of lights along the lane on which the strike was rolled. The controller of the inventive lighting system may also include an audio interface for coupling to an output of an audio device, such as the bowling center's audio system. With such an audio interface, the controller may operate in a music mode whereby the controller controls the lighting of each of the light modules in response to the audio signal received through the audio interface. In this manner, the lighting system may be synchronized with the music played throughout the bowling center.

[0060] The invention extends to and envisages of any one of the above aspects taken alone, a combination thereof, or simply any combination of their common features and the optional features thereof.

[0061] These and other features, advantages, and objects of the present invention will be further understood and appreciated by those skilled in the art by reference to the following specification, claims, and appended drawings.

[0062] The present invention may be carried out in various ways and various embodiments in accordance with the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Fig. 1 is an electrical diagram of a lighting system constructed in accordance with a preferred embodiment of the present invention;

Fig. 2 is a perspective top view of the bowling lanes of a bowling center illustrating one possible implementation of a preferred lighting system in accordance with the invention;

Fig. 3 is a perspective view of a preferred division capping assembly in which light strings of the inventive lighting system may be mounted;

Fig. 4 is a sectional elevational view of a portion of the division capping assembly shown in Fig. 3;

Fig. 5 is a sectional elevational exploded view of the two preferred components of the division capping assembly shown in Fig. 3;

Fig. 6 is a perspective view of a preferred light module that may be used in the inventive lighting system;

Fig. 7 is an electrical diagram in block form of an exemplary light string and address module of the inventive lighting system;

Further, this division capping construction allows for quick access and replacement of the lighting modules. Although the light strings are described as being run within the division capping assemblies, the light strings may also be run on or within the ball return capping assemblies.

[0072] As shown in Fig. 6, each light module 140 may be formed on a circuit board 30 and mounted in a housing 40. Preferably, light module 140 includes a multicolor lighting device including three light emitting diodes (LEDs) or a single LED with multiple (3) colors as light sources. More preferably, these LEDs include a red LED 32, a green LED 34, and a blue LED 36. By providing red, green, and blue LEDs, which are the primary additive colors, each light module 140 may be controlled to emit not only one of the red, green, or blue colors, but also to emit white, cyan, yellow, or magenta when combinations of LEDs 32, 34, and 36 are illuminated.

[0073] To project the light from LEDs 32, 34, and 36, a portion 44 of the upper surface of housing 40 is sloped upward to define an opening 46 through which the light is projected. An inner surface of portion 44 preferably has a reflector 48 disposed thereon. In this manner, light modules 140 may be disposed within channel 24 so as to project the light back toward the approach area of the bowling lanes so as to appear more bright to the bowlers and spectators. Housing 40 may be provided with an aperture 42 defining a connection port 35 from which connector pins 38 extend from circuit board 30. Connector pins 38 are provided to allow coupling to a plug 50 of a wiring cable 125 which extends from the opposite end of the next light module 140. It will be appreciated that port 35 may be configured as a female port having receptacles rather than a male port having pins 38.

[0074] Light module housing 40 may also include a similar port at its opposite end for coupling to a wiring cable 125 of another light module 140 or may have the cable 125 more permanently mounted thereto. With a port 35 at one end and a cable 125 with a plug 50 provided at an opposite end, such light modules may be serially coupled together to form a light string. It will be appreciated, however, that wiring cables 125 may be permanently mounted to both ends of light module 140 so as to have a plurality of such light modules 140 permanently strung together. However, such a permanent mounting may be less desirable if it should become necessary to replace any one light module within the light string.

[0075] Having described the physical components of this preferred embodiment of a lighting system in accordance with the present invention, the electrical and functional aspects of the inventive lighting system are described below with reference to Figs. 7 through 9. As shown in Fig. 7, each address module 120 includes a pair of cable connectors 111 and 112 for coupling into and forming a part of data cable 115. It will be appreciated by those skilled in the art that connectors 111 and/or 112 may be mounted within an address module housing or be mounted at the end of a cable extension so as to mate with the connector of an upstream or downstream address module. As shown in Fig. 7, cable 115 includes power supply lines 113 for providing power to each address module system, ground lines 114, and an earth ground line 116. Further, cable 115 includes two lines 117 upon which is transmitted a differentiated load signal, a second pair of lines 118 upon which is transmitted a differentiated data stream, and a third pair of lines 119 upon which is transmitted a differentiated clock signal. The load signal, data stream, and clock signal are described in more detail below.

[0076] Address modules 120 also include a load line interface 122 coupled to line pair 117, a data line interface 123 coupled to line pair 118, and a clock line interface 124 coupled to line pair 119. Load, data, and clock line interfaces 122 through 124 receive the differentiated signals on the respective line pairs and generate a load signal, a data stream signal, and a clock signal, respectively. Preferably, these interfaces utilize an optical coupling so as to reduce the current drawn from bus 115.

[0077] Address modules 120 further include a first power converter 121a and a second power converter 121b. First power converter 121a is coupled to the ground and power lines of cable 115 for supplying power to those portions of interfaces 122, 123, and 124 that are coupled to cable 115. Second power converter 121b is provided to convert power received from an external power supply and supply power to light strings 130 and to those portions of interfaces 122, 123, and 124 that are optically isolated from cable 115. By using two power converters, the light strings may be isolated from cable 115.

[0078] The data stream signal as output from data line interface 123 is supplied to an 8-bit shift register 126. As the data stream signal is received by shift register 126, it is shifted through shift register 126 in response to the clock signal output from clock line interface 124. As data is shifted through register 126, it is passed along on line 138 of wiring cable 125 to the first light module 140_1 of the light string 130. This data is received by a 3-bit shift register 146, which shifts this data therethrough in response to the same clock signal to which 8-bit shift register 126 responds. As the data is shifted through 3-bit shift register 146, it is passed downstream to the 3-bit shift register of the next light module. When twenty light modules 140 are provided in a light string, the serially-connected 3-bit shift registers of each of the light modules 140 and the 8-bit shift register 126 of the associated address module 120, effectively operate as a 68-bit shift register. As such, new data may be loaded into the shift registers every 68 clock pulses. Thus, the first 60 bits of a data signal transmitted on line pair 118 will correspond to twenty 3-bit data signals used as activation signals to control the LEDs 32, 34, and 36 in each light module. The last 8 bits of the data stream will cor-

sor 200. In response to information received at its inputs, decode logic circuit 206 transmits control signals to first and second output ports 208 and 210 that causes these output ports to output the data received on data bus 225 through their respective output lines. Further, decode logic circuit 206 may respond by sending a read signal to input port 212 to cause it to read inputs from front panel switch interface 216 or configuration dip switches 218 and to transmit these inputs on data bus 225 so that they may be received by processor 200. As will be explained further below, decode logic circuit 206 further transmits read and write signals to an analog-to-digital (A/D) converter 240 of an audio interface 228 to cause it to send or receive data on data bus 225.

[0086] As shown in Fig. 9, central controller 110 may further include an external device interface 226 to which an external device, such as the bowling center's bowling scoring system, may be connected. Preferably, interface 210 is a standard RS-232 Serial Port and processor 200 includes a UART so as to enable any conventional personal computer (PC) or server to be connected to central controller 110. By connecting the bowling scoring system to external device interface 226, processor 200 may receive prompts from the scoring system that identify a particular lane or lane pair, and an event that occurred at the identified lane. For example, the bowling scoring system may inform central controller 110 that a strike has been rolled on lane 4. In such an event, central controller 110 could respond by transmitting data streams including the addresses for the two address modules on the adjacent borders of lane 4 so as to create a specific light show with respect to that lane. Thus, the light bordering that lane may be used to create a light show in synchronism with the exciter graphics shown on the scoring system displays.

[0087] Central controller 110 may further include an audio interface 228 which enables central controller 110 to interface with an audio device or system, such as the bowling center's audio system. Audio interface 228 preferably includes RCA input jacks 230 into which an audio line level signal may be received from the audio device or system. The line level signal is then split and applied to a high pass filter 232, a band pass filter 234, and a low pass filter 236. Filters 232, 234, and 236 are provided to separate the input audio signal into its treble, midrange, and bass frequency components. Although separation of the treble, midrange, and bass frequencies is disclosed, the audio signal could be separated into any number of different frequency bands. The outputs of each of these filters are applied to an analog switch 238, which is responsive to band select signals supplied from processor 200 to select one or more of the separated frequency components to supply to the input of A/D converter 240. A/D converter 240 converts the amplitude of the selected frequency component of the input audio signal into an 8-bit digital value. This 8-bit digital value may be output on data bus 225 and received by processor 200 when it receives a write-enable signal from decode logic circuit 206.

[0088] Through the operation of a switch on front panel switch interface 216 or the operation of a configuration dip switch 218, processor 200 may be set in a music mode whereby it instructs decode logic circuit 206 to enable A/D converter 240 to output a digital value representing the amplitude of a received audio signal on data bus 225. Processor 200 receives this digitized amplitude level and responds by selecting a light display data pattern that may vary in some respect as a function of the digitized amplitude level of the input audio signal. Further, as noted above, processor 200 may select either the treble, midrange, or base frequency component of the input audio so as to change the lighting patterns in response to either the amplitude of the base, midrange, or treble component levels. Thus, processor 200 may control the light patterns generated by the light strings in synchronism with the music played on the bowling center's audio system. Processor 200 may be configured so as to generate a lighting pattern in which the light strings are illuminated to simulate a power meter of, for example, a graphic equalizer, or may control the different LEDs of each light module so as to change color in response to the component amplitude levels of the input audio signal. The specific manner by which processor 200 responds to the input audio signal may be set by an operator through the actuation of a switch on front panel switch interface 216 or the operation of a dip switch 218. It will be appreciated by those skilled in the art that processor 200 may be programmed to respond to the input audio signal level to create virtually any sequence of lighting patterns in response to the characteristics of the input audio signal. It should further be noted that processor 200 may dynamically vary the bid selection signal applied to analog switch 238 so as to modulate the different lights in each module in response to different frequency components of the input audio signal.

[0089] Front panel display interface 220 is preferably coupled to a display that is mounted in a location that may be viewed by the operator. By providing a display device, information, such as the operating mode, may be displayed to an operator. The information to be displayed on the display device may be transmitted from one of the memories or processor 200 over data bus 225 to output port 210, which, in turn, transmits the display information to front panel display interface 220 when a write-enable signal is received from decode logic circuit 206. The display device may further be controlled directly by processor 200, which is directly coupled to front panel display interface 220.

[0090] Data memory 204 is provided as a "scratch pad" memory for processor 200 and for storage of display patterns that may be downloaded via external device interface 226 from an external device. In this manner, the various lighting patterns that may be displayed by the lighting system may be varied at any time

vation signal uniquely associated with each light module; a plurality of address (120_n) modules each associated with and coupled to one of said light strings; and a central controller (110) coupled to said plurality of address modules for generating and transmitting activation signals to said light modules to independently control said light modules, wherein said central controller transmits activation signals to the light modules of a specific light string while transmitting therewith an address to which the address module associated with the specified light string will respond by enabling the light modules of the associated light string to respond to the activation signals transmitted from said central controller.

6. A system as claimed in claim 5, wherein said central controller includes an interface for connecting to an external system, said central controller being responsive to signals received from the external system for generating and transmitting activation signals to said light modules so as to create a selected graphic display pattern.

7. A system as claimed in claim 5 or claim 6, wherein said central controller includes a memory for storing data representing a plurality of lighting patterns, said central controller selects one of the plurality of lighting patterns, reads the stored data representing the selected data pattern, and generates and transmits activation signals to said light modules in order to generate the selected light pattern on said plurality of light strings.

8. A lighting system (100) for a bowling center having at least two bowling lanes, said lighting system comprising a light string (130_n) disposed along a divider (16) separating said two bowling lanes, said light string including a plurality of light modules each including a multi-color lighting device (32,34,36) for emitting light having one of a plurality of selectable colors.

9. A system as claimed in claim 8, wherein each of said light modules includes a red LED, a green LED, and a blue LED, said LEDs being independently activated in response to an activation signal.

10. A system as claimed in claim 8 or claim 9, further including a controller coupled to said light string for generating and transmitting activation signals to said light modules to independently activate said light sources of said light modules.

11. A wide-area graphic display system (100) comprising: a plurality of light strings (130_n) each including a plurality of independently controllable light modules (140_n) that emit light in response to an activation signal uniquely associated with each light module; a plurality of address modules (120_n) each associated with and coupled to one of said light strings; and a central controller (110) coupled to said plurality of address modules for generating and transmitting activation signals to said light modules to independently control said light modules, wherein said central controller transmits activation signals to the light modules of a specific light string while transmitting therewith an address to which the address module associated with the specified light string will respond by enabling the light modules of the associated light string to respond to the activation signals transmitted from said central controller to thereby generate a graphic display.

12. A system as claimed in any preceding claim, wherein each of said light modules include a red LED, a green LED, and a blue LED, said LEDs being separately controllable such that said central controller may separately select one of at least seven different colors to be emitted from each of said light modules by transmitting an activation signal to selected ones or combinations of said red, green, and blue LEDs.

13. A system as claimed in any preceding claim, wherein said controller includes a memory for storing data representing a plurality of lighting patterns, said controller selects one of the plurality of lighting patterns, reads the stored data representing the selected data pattern, and generates and transmits activation signals to said light modules in order to generate the selected light pattern on said plurality of light strings.

14. A system as claimed in any one of claims 5 to 13, wherein said plurality of light strings are physically mounted in parallel to one another.

15. A system as claimed in any one of claims 5 to 13, wherein said plurality of light strings are mounted in a single plane.

16. A system as claimed in any one of claims 5 to 13, wherein the light modules of a light string are coupled in series.

17. A system as claimed in any preceding claim including a plurality of division capping assemblies, each mounted on a lane pair divider, each of said division capping assemblies defining a channel and having a transparent cover such that a light string may be run within said channel and the light from the light modules may be emitted through said transparent cover.

18. A system as claimed in claim 2, claim 5, claim 8 or claim 11 or any claim dependent upon any of claims

trol circuit is responsive to a signal from the automatic scoring system that identifies a bowling lane by creating a light show on the light strings bordering the identified lane.

28. A system as claimed in claim 26 or claim 27, wherein said control circuit is responsive to a signal from the automatic scoring system that identifies a bowling lane and an event that occurred on the identified bowling lane by selecting a display pattern associated with the identified event creating a light show having the selected display pattern on the light strings bordering the identified lane.

29. A system as claimed in claim 26 or claim 27 or claim 28, wherein said control circuit includes an audio interface for connection of an output of an audio device, said control circuit generates and transmits activation signals to said light modules in order to generate a light pattern on said plurality of light strings that changes in appearance in response to changes in a characteristic of an audio signal received from the audio device.

30. A system as claimed in any one of claims 23 to 28, wherein each of said light modules includes a multicolor lighting device for emitting light of different colors such that said control circuit may select colors of the light to be emitted from each one of said light modules.

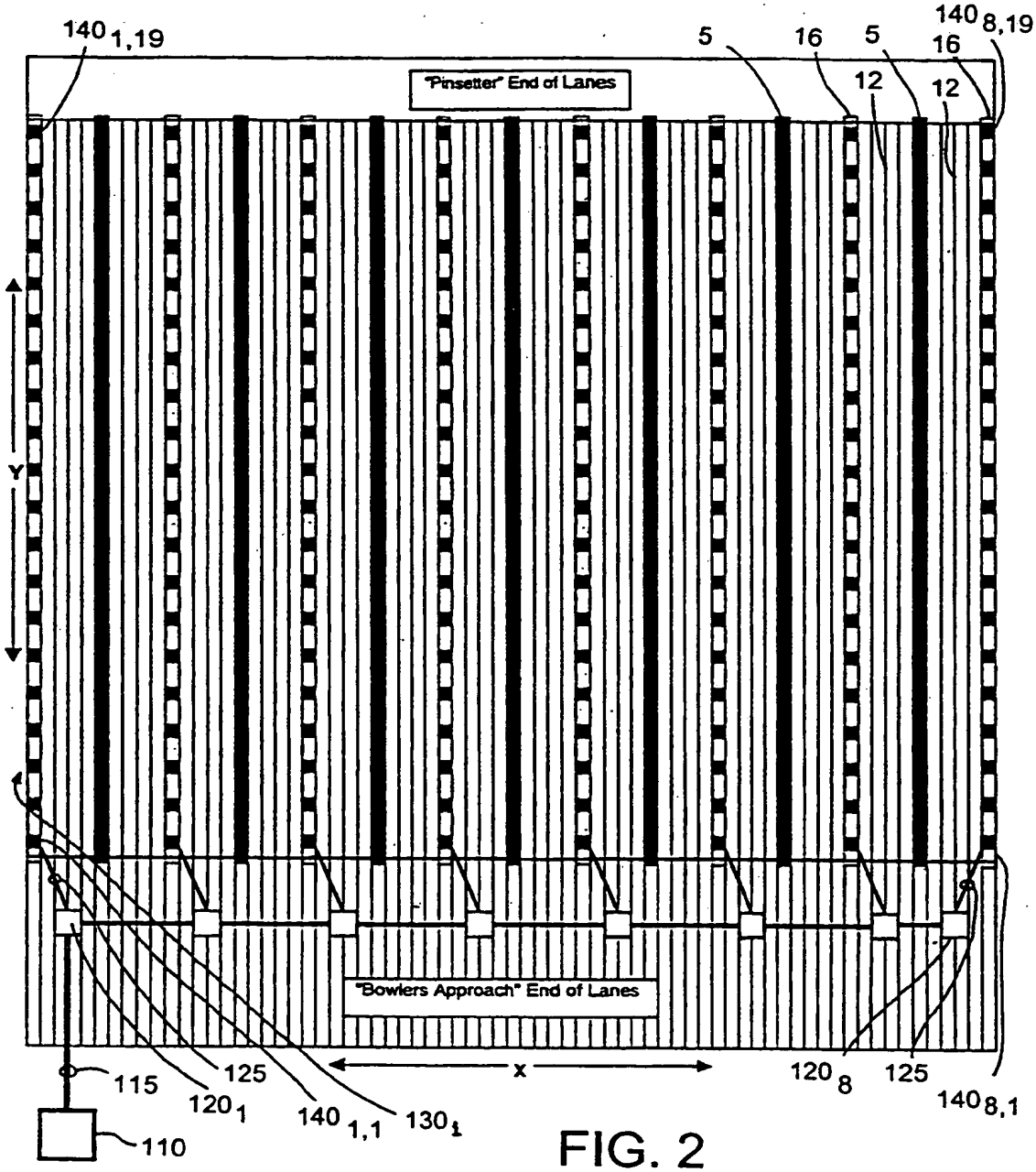


FIG. 2

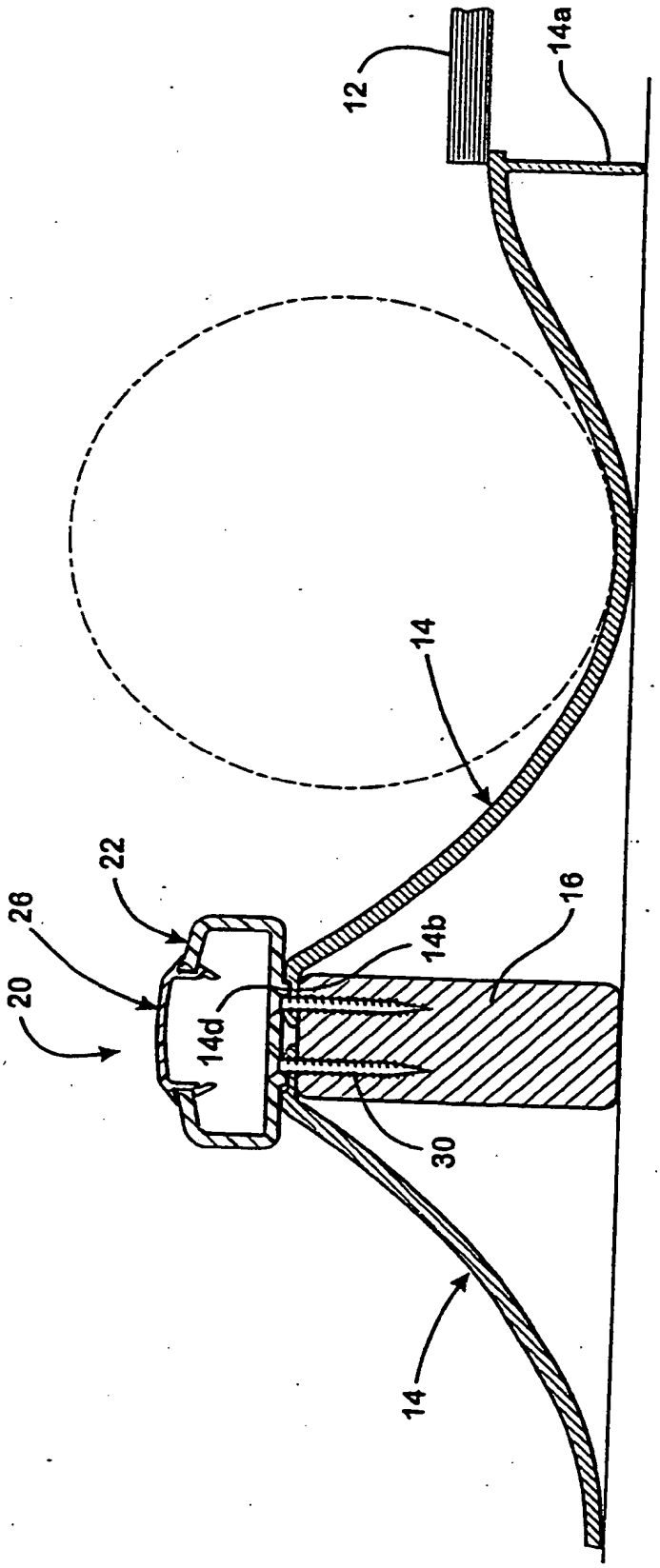
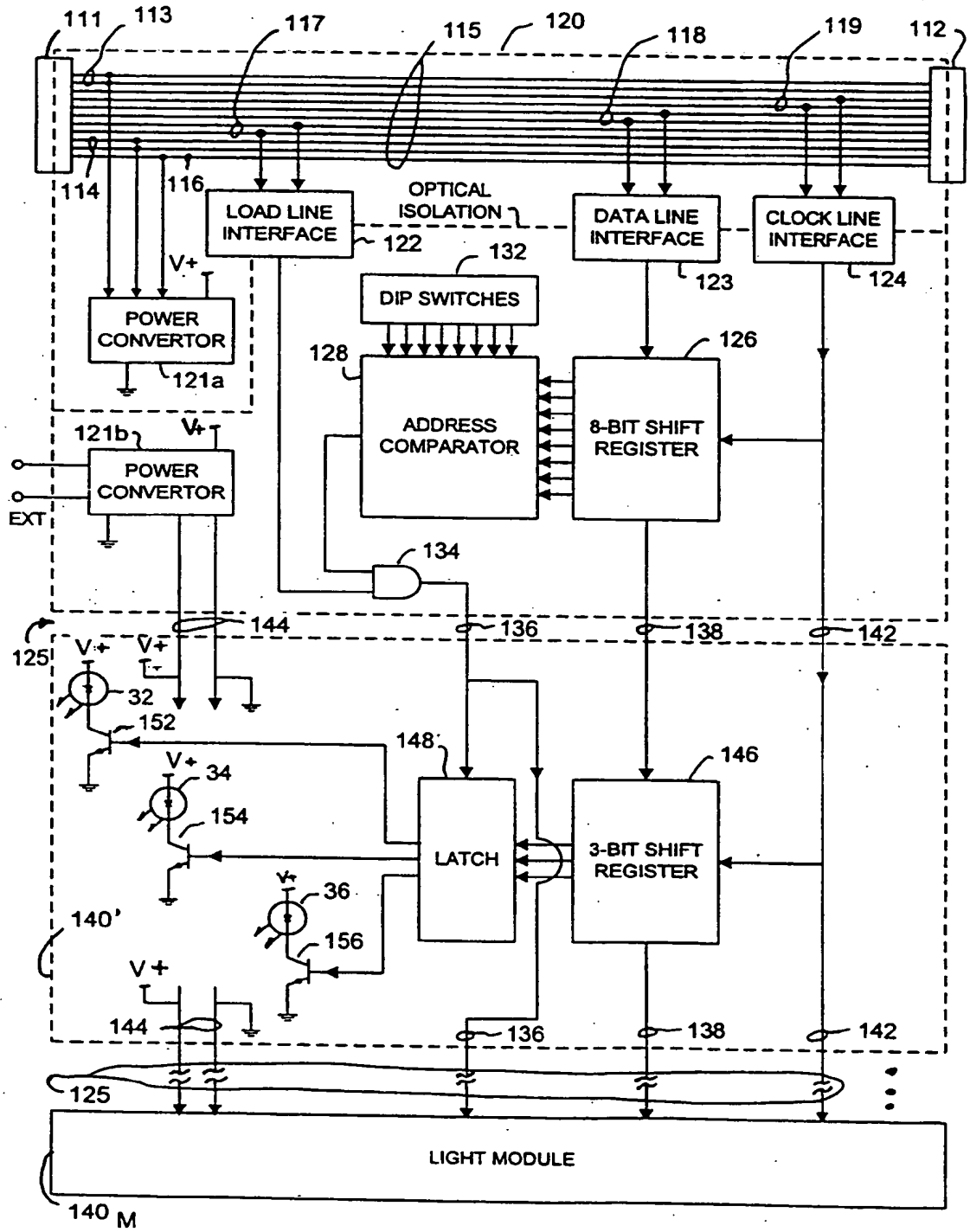


FIG. 4

FIG. 7



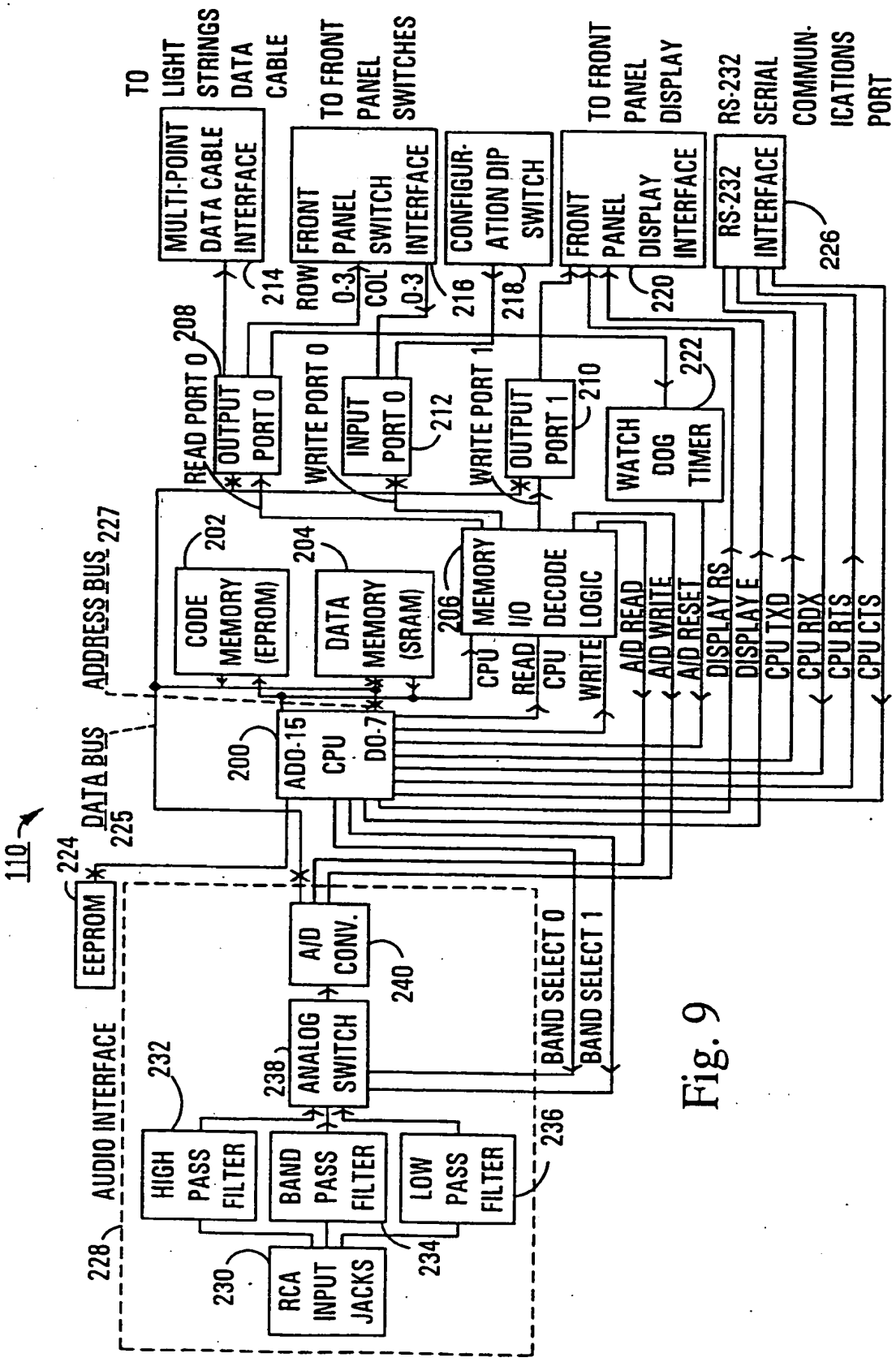


Fig. 9

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 942 631 A3

(12) EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
25.04.2001 Bulletin 2001/17

(43) Date of publication A2:
15.09.1999 Bulletin 1999/37

(21) Application number: **99301842.3**

(22) Date of filing: **11.03.1999**

(51) Int. Cl.[7]: **H05B 37/02**, A63D 1/00, H05B 33/08, A63J 17/00

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **11.03.1998 US 38449**

(71) Applicant:
BRUNSWICK BOWLING & BILLIARDS CORPORATION
Muskegon Michigan 49443 (US)

(72) Inventors:
- **Recknagel, Troy Arnold**
  Muskegon, Michigan 49441 (US)
- **Richardson, William Orvil**
  Grand Haven, Michigan 49417 (US)

(74) Representative:
Miller, James Lionel Woolverton et al
Kilburn & Strode,
20 Red Lion Street
London WC1R 4PJ (GB)

(54) Bowling center lighting system

(57) The lighting system (100) of the present invention includes at least one light string (130_n) having a plurality of independently controllable light modules (140_n), each emitting light in response to an activation signal uniquely associated with the light module. The lighting system (100) preferably includes a controller (110) coupled to the light strings for generating and transmitting activation signals to the light modules to independently control the lights of the light modules. Each of the light modules may include a multi-color lighting device (32,34,36) for emitting light of different colors such that the controller may select colors of the light emitted from each one of the light modules. The lighting system may also include a plurality of address modules (120_n) each associated with and coupled to one of the light strings and coupled to the controller so that the controller may transmit activation signals to the light modules of a specific light string by transmitting an address to which the associated address module will respond by enabling the light modules of the associated light string to respond to the activation signals transmitted with the address signal from the controller.

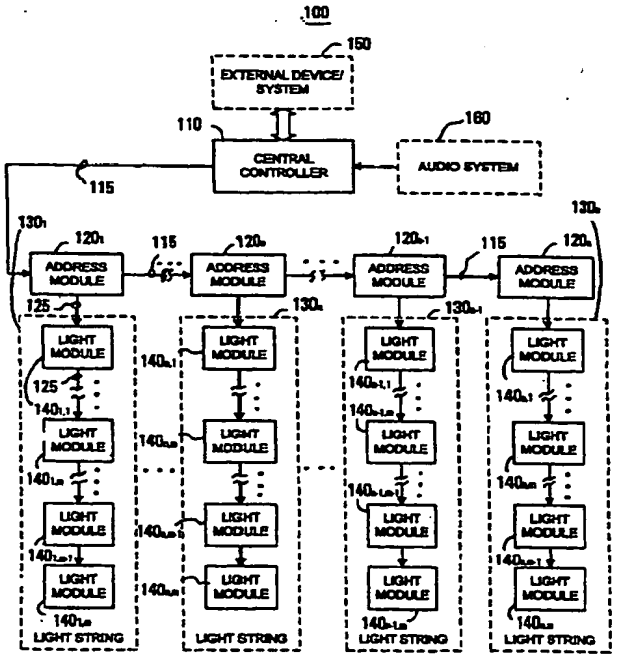


FIG. 1

EP 0 942 631 A3

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 99 30 1842

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

07-03-2001

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5420482 A	30-05-1995	AU 6034394 A	29-08-1994
		CA 2155858 A	18-08-1994
		WO 9418809 A	18-08-1994
GB 2308535 A	25-06-1997	US 5882263 A	16-03-1999
US 5410328 A	25-04-1995	NONE	
EP 0534710 A	31-03-1993	AT 133313 T	15-02-1996
		AU 657152 B	02-03-1995
		AU 2138892 A	01-04-1993
		CA 2076171 A,C	27-03-1993
		DE 69207692 D	29-02-1996
		DE 69207692 T	17-10-1996
		ES 2082384 T	16-03-1996
		JP 6267668 A	22-09-1994
		KR 206051 B	01-07-1999
		MX 9205152 A	01-03-1993
		US 5329431 A	12-07-1994
		US 5769527 A	23-06-1998
		US 5209560 A	11-05-1993
US 5402702 A	04-04-1995	DE 4225392 A	03-02-1994
		FR 2694422 A	04-02-1994
		GB 2268845 A,B	19-01-1994
US 4887074 A	12-12-1989	NONE	
US 5008595 A	16-04-1991	US 4870325 A	26-09-1989
US 5599236 A	04-02-1997	US 5449326 A	12-09-1995
		US 5584766 A	17-12-1996
		US 5577971 A	26-11-1996
		AU 4996093 A	03-03-1994
		DE 69302278 D	23-05-1996
		DE 69302278 T	05-12-1996
		EP 0652797 A	17-05-1995
		ES 2087768 T	16-07-1996
		WO 9403244 A	17-02-1994
US 5225765 A	06-07-1993	US 4975629 A	04-12-1990
		US 4633161 A	30-12-1986
		US 4823069 A	18-04-1989
		US 5455490 A	03-10-1995
		US 5672941 A	30-09-1997
		US 5319301 A	07-06-1994

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82